

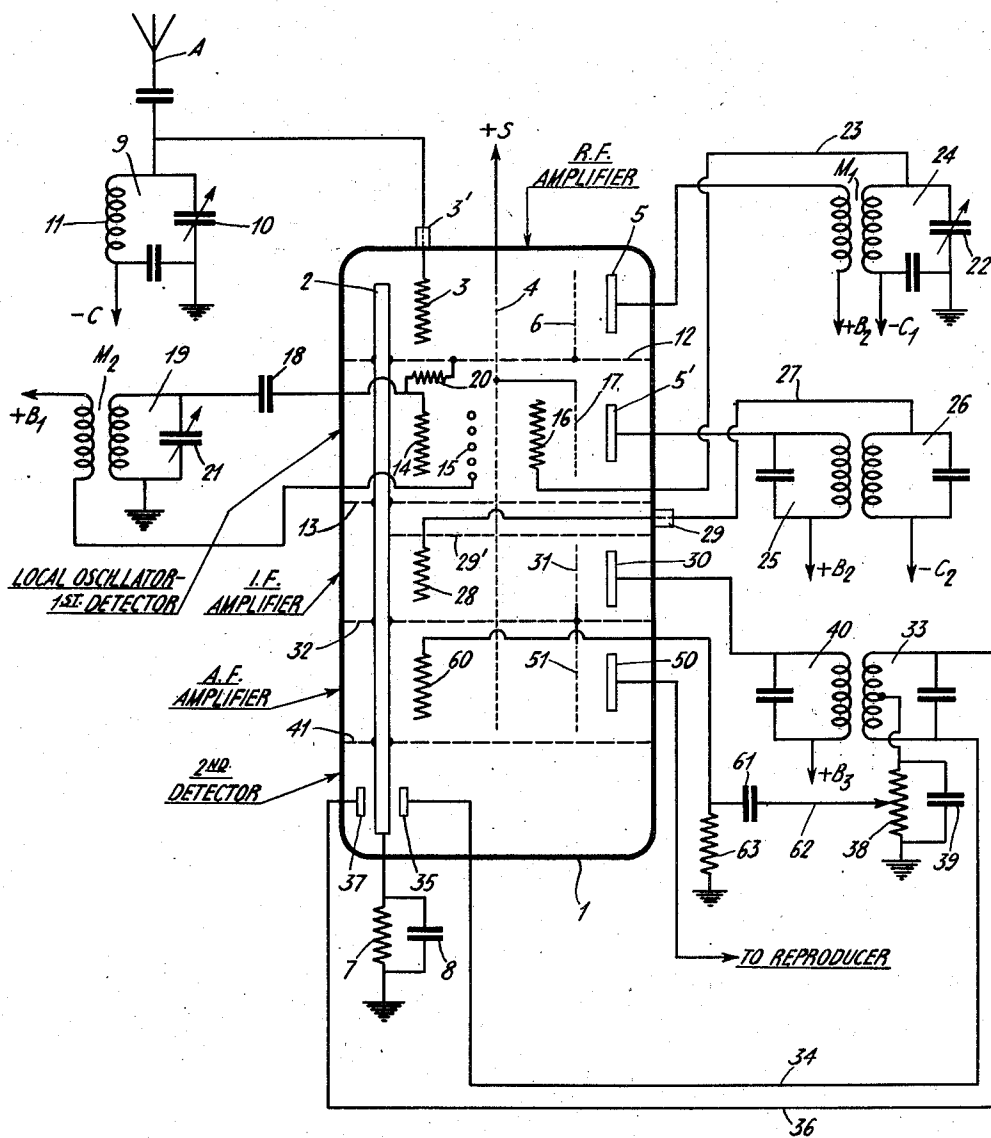
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MULTIPLE FUNCTION TUBE

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MULTIPLE FUNCTION TUBE

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My present invention relates to multiple duty tubes, and more particularly to signal receiving circuits embodying multifunction tubes of the type wherein certain electrodes are common to different electrode sections of the tube.

One of the main objects of the invention is to provide a signal reception system employing cascaded amplifier and demodulator networks, and the cascaded networks being connected to the electrodes of a single tube; the electrodes of the tube being arranged in shielded sections of the tube according to system functions, and certain of the electrodes being common to a plurality of the sections.

Another important object of the invention is to provide a superheterodyne type of receiver which employs a single tube for all functions up to, and including, that of audio amplification, the single tube being provided with a plurality of shielded electrode sections, and the electrodes of each section functioning to perform a different function; certain of the electrodes of one section such as the cathode and screen electrodes, being common to another section.

Another object of the invention is to provide a multisection tube for radio reception, each section including electrodes for performing a desired reception function, the sections being provided by spaced metallic shielding partitions within the tube envelope, and the metallic partitions additionally functioning, in certain sections, as connectors between the cathode of the section and another electrode therein.

Still another object of the invention is to generally improve the economy of construction of radio receivers, and more particularly to provide a superheterodyne receiver utilizing a single tube for the various functions of the receiver, and the construction being reliable and efficient in operation.

The novel features which I believe to be characteristic of my invention are set forth in particularity in the appended claims, the invention itself, however, as to both its organization and method of operation will best be understood by reference to the following description taken in connection with the drawing in which I have indicated diagrammatically a circuit organization whereby my invention may be carried into effect.

Referring now to the accompanying drawing, wherein there is shown the circuit diagram of a superheterodyne type of receiver embodying one form of the present invention, it will be observed that the multiple function tube used for the receiver embodies an envelope 1 which may assume

any configuration best suited for the geometrical disposition of the electrodes. The envelope 1 is provided, by way of example, with five shielded sections. The first section houses the electrodes for the radio frequency amplifier. The second section is the converter, or combined local-oscillator-first detector.

The third section includes the electrodes performing the intermediate frequency amplification function. The fourth section includes the audio frequency amplifier electrodes. Finally, the fifth section includes the electrodes adapted to perform the second detection, or demodulation, function. The various circuits shown outside the tube envelope 1 are connected to the different electrodes of these various sections so that the different functions are performed.

The various circuits utilized are conventional in nature, and will be understood by those skilled in the art from the schematic representation in the drawing. Considering, therefore, the first section of the tube, it will be observed that this section includes a cathode 2, a signal input grid 3, and an anode 5.

The cathode 2 is of the indirectly heated type, and for this reason it will be understood that the heater element (not shown) runs through the entire length of the cathode 2. The cathode is common to all the sections, and therefore it will be seen that it furnishes a plurality of electron streams, which electron streams are parallel. One side of the cathode is grounded through a resistor 7 shunted by a condenser 8. The signal input grid 3 of the radio frequency amplifier section is connected to the high alternating potential side of the tunable input circuit 9. A signal collector A, which may be the usual antenna, is connected to the tunable input circuit 9. The grounded side of the tuning condenser 10 is connected to the low alternating potential side of the coil 11 to a blocking condenser, and the low alternating potential side of coil 11 is to be connected to a source of negative grid bias C.

This grid bias source may be a fixed normal bias, or it may be a variable bias derived from the customary automatic gain control network. The anode 5 is connected to a source of B voltage through the primary winding of the radio frequency coupling transformer M₁. A screen grid electrode 4 is disposed between the signal grid 3 and the anode 5, and it will be observed that this screen grid electrode is common to the next three sections of the tube. The screen is connected to a proper positive potential source S. The signal input grid 3 is connected to a metallic shielding

cap 3' arranged at the top of the tube in the usual manner.

For the sake of simplicity of disclosure only a schematic representation has been given of the electrodes. It will be understood, of course, that each of the electrodes is constructed in the well known cylindrical manner, and therefore concentrically surround the cathode 2.

The first section is provided by spacing an electrostatic shield 12, represented by a dotted line, from the top of the tube. This shield 12 in constructional form may be made of a thin disc, circular in shape, of nickel or any other metal suitable for the purpose. This shield will, of course, in the actual tube construction be provided with an aperture through which the cathode 2 may be passed. The shield 12 is electrically connected to the cathode 2 as by welding or any other manner, and hence the shield 12 is established at cathode potential. Because of this the shield 12 may be used as a conductor, or connector, to connect a suppressor grid 6 to the cathode 2, the suppressor grid being disposed between the screen grid 4 and the anode 5.

In actual construction the shielding disc 12 will be provided with a circular slot so that the screen 4 can be passed therethrough. It is again emphasized that it is the purpose of the present invention to have each of electrodes 3, 4, 6, and 5 concentrically surrounding the cathode 2. However, it is to be clearly understood at the same time that if the configurations of the electrodes other than the cathode are desired to be other than cylindrical, such other configurations are within the scope of the present invention. The purpose of the representation of these various electrodes in the drawing is purely schematic, is merely given to illustrate the invention.

The electrodes in the converter section of the tube are disposed between the electrostatic shield 12 and a second electrostatic shield 13. The construction of the shield 13 is similar to that of shield 12, and also includes an aperture through which the cathode 2 may pass, and a slot concentric with the slot in shield 12 through which the common screen electrode 4 may pass.

Considering now the electrodes disposed in the converter section of the tube, there is disposed between the cathode and the anode 5' five cold electrodes. Between the cathode and the screen there is disposed the local oscillator grid 14 and the oscillator anode 15. Between the screen and the anode 5' there is disposed the radio frequency signal input grid 16 and a second screen 17. The screen 17 is connected to the screen 4, and hence is at the same positive potential. The signal input grid 16 is disposed between the two positive screens. The oscillator anode 15 is disposed between the oscillator grid 14 and the screen 4.

These various electrodes between the cathode 2 and anode 5' are concentrically disposed about cathode 2 in the order shown. The tunable oscillator circuit is connected between ground and a condenser 18, the latter condenser coupling the tunable oscillator circuit 19 to the oscillator grid 14. The usual grid leak resistor 20 of the oscillator is disposed within the converter section of the tube and is connected to the shield 12. This provides economy of construction. The oscillator anode electrode 15 is coupled to the tunable circuit 19 by means of coupling M₂, a positive source of voltage B₁ being connected to the oscillator anode electrode 15. The tunable oscillator circuit 19 includes the variable tuning condenser 21, and it will be understood that the rotors of

variable tuning condensers 10, 21 and 22 can be uni-controlled.

The signal grid 16 of the converter section is connected by lead 23 to the high alternating potential side of the tunable signal circuit 24. A source of negative grid bias C₁ is shown arranged for connection to the signal grid 16, and this source may be the same automatic volume control source connected to grid 3.

An intermediate frequency resonant circuit 25 is connected to the anode 5', the low potential side of this circuit being connected to a source of positive voltage B₂. The beat energy of intermediate frequency is produced in circuit 25 by virtue of the converter function of the second section 15 of the tube. It is not necessary for the purposes of this application to explain the theoretical basis for the conversion action. It is sufficient to point out that due to the phenomenon of "electron coupling" the electron stream between cathode 2 and anode 5' is affected by the local oscillator frequency variation and the signal frequency variation in such a manner as to produce energy of a desired intermediate frequency in the circuit 25.

The function of screen 4 in the converter section of the tube is to electrostatically shield the oscillator electrodes from the signal grid electrode. The pentagrid arrangement, and their functions, in the second section of the tube are well known to those skilled in the art, and a single tube comprising the electrodes of the converter section of the tube is known as a 6A7 type tube, or a 1A6 type tube.

The resonant circuit 26 is tuned to the operating intermediate frequency and is coupled to the circuit 25. The high potential side of circuit 26 is connected by lead 27 to the signal input grid 28 of the intermediate frequency amplifier section of the tube. In order to avoid intermediate frequency feedback a metallic cap 29 may be attached to the side of the tube envelope through which lead 27 passes, and an electrostatic shield 29' may be spaced a sufficiently small distance from shield 13 to permit the lead 27 to be run from the cap 29 to the grid 28. This auxiliary shield 29' may be of any configuration desired, and should be of a small size, and electrically connected to cathode 2.

The electrostatic shield 29' may be constructed in the form of an arcuate element disposed against disc 13 so as to provide a narrow conduit through which the lead 27 may be run from the cap 29 to the grid 28. Between the anode 30 and the cathode 2 of the third section of the tube is disposed the grid 28, the screen 4 and a suppressor grid 31. The suppressor grid, as in the case of the first section of the tube, may be connected to the electrostatic shield disc 32. Except for the shielded lead 27, the construction of the intermediate frequency amplifier section is substantially similar to that of the radio frequency amplifier section. The amplified intermediate frequency energy is impressed upon a full wave diode detector circuit which comprises the tuned input circuit 33 having its low alternating potential side connected by lead 34 to the diode anode 35. The high alternating potential side of input circuit 33 is connected by lead 36 to the diode anode 37. The electrodes 35 and 37 are disposed adjacent cathode 2.

The electrodes 35 and 37 may each be semi-circular in configuration, and generally follow the construction of the diode sections of the well known 55 type tube. The input circuit 33 has

the midpoint of the coil thereof connected to ground through resistor 38 shunted by the bypass condenser 39. The circuit 33 is magnetically coupled to the output circuit 40 of the intermediate frequency amplifier section. The electrostatic shield 41 is spaced from the bottom of the tube envelope 1, and the diode anodes 35 and 37 are disposed in this lower space.

Between electrostatic shields 41 and 32 there are disposed the electrodes of the audio frequency amplifier section. These electrodes comprise the cathode 2, the anode 50, suppressor grid 51, screen grid 4 and the signal input grid 60. The audio frequency component of rectified signal energy developed across resistor 38 is impressed upon the signal grid 60 through a path which includes the condenser 61.

The lead 62 between resistor 38 and condenser 61 is made adjustable, and the grid side of condenser 61 is grounded through resistor 63. The suppressor grid 51 is maintained at cathode potential by connecting it to the electrostatic shield 32, or, if desired, the grid could be connected to the shield 41. The anode 50 may be connected to any desired type of reproducer, and it is to be clearly understood that the automatic volume control voltage for providing the negative biases C, C₁, C₂ can be derived from the resistor 38 in the well known manner. Additionally, it is to be understood that the positive voltages S, B, B₁, B₂, B₃ may be derived from a common voltage supply source in the usual fashion.

It will now be seen that the various functions of a superheterodyne receiver have been provided by the use of a single tube which is divided into a plurality of electrostatically shielded sections, and each section including the different electrodes for the different functions. The cathode 2 provides the electron streams for the different sections, and a screen electrode 4 provides screening for the first four sections. It is for this latter reason that the audio amplifier section is disposed between the intermediate frequency amplifier section and the second detector or demodulator section. It will also be observed that the electrostatic shields additionally function to maintain suppressor grids, where they are used, at cathode potential.

Of course, the present invention can also be employed in connection with a receiver of the tuned radio frequency type. In such a case, there would be a radio frequency amplifier section used in place of the converter section. Additionally, while I have indicated and described several systems for carrying my invention into effect, it will be apparent to one skilled in the art that my invention is by no means limited to the particular organization shown and described, but that many modifications may be made without departing from the scope of my invention, as set forth in the appended claims.

What I claim is:

1. A multiple function tube having an enclosing envelope, a metallic shield extending between the side walls of said envelope, a cathode extending through said shield, an anode on each side of said shield, a signal grid and a suppressor grid located between said cathode and each of said anodes, said suppressor grids being directly connected to said shield and each of said signal grids lying on one side only of said shield.

2. A multiple function tube comprising an envelope, a plurality of spaced metallic shields extending transversely of said envelope for substantially the entire area thereof, each of said shields being provided with an arcuate slot, a common cathode extending through said shields, a curved screen electrode extending through said slots and out of contact with said shields, an anode between each pair of adjacent shields and independent control electrodes between each pair of adjacent shields, said control electrodes being also located between said cathode and said screen electrode.

3. A multiple function tube comprising in combination, a common tube envelope, a plurality of spaced apart metallic shields extending transversely across said envelope, at least three electrodes between each pair of adjacent shields said electrodes comprising a first grid, a second grid and an anode, a cathode extending through and directly connected to each of said shields, lead wires passing through said envelope and connected respectively to said first grids, and direct connections within said envelope between said second grids and said metallic shields.

4. A multiple function tube comprising in combination, a common tube envelope, a metallic shield extending transversely of said envelope, to form at least two shielded tube sections; a control grid, a second grid and an anode in each of said sections; a single cathode extending through said shield into both tube sections, a leak resistor within said envelope connecting one of said control grids and said shield, and a direct connection within said envelope between the second grid of the other tube section and said shield.

5. A multiple function tube having an enclosing envelope, a metallic shield extending transversely of said envelope, a cathode passing through and extending on both sides of said shield, an anode on each side of said shield, a signal grid and a second grid between each of said anodes and said common cathode, connections within said tube envelope between said second grids and said shield, a lead wire connected to one of said control grids and passing through said envelope and a metallic shield enclosing said lead wire.

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